as intravenously, percutaneously or intramuscularly, while applying thereto a ultrasonic vibration, the therapeutic effects of the medicament is significantly enhanced. When a ultrasound from a ultrasonic element is applied to the liquid containing the booster and medicament, cavitation occurs in the liquid composition, and the medicament is diffused and penetrated into the desired portion of the biobody by the aid of vibration induced by the cavitation. The cavitation occurs when the level of vibration energy overs a certain threshold value. When the ultrasound is applied to the liquid composition of the invention, the threshold value of the vibration energy lowers due to the presence of a plenty of microbubbles of a gas. That is, the microbubbles of a gas act as nucleus of cavitation and thereby the cavitation occurs more easily. Accordingly, according to the invention, the desired ultrasonic energy necessary for the desired diffusion and penetration of a medicament is achieved even by less energy of ultrasonic vibration energy.

The desired ultrasound is applied by conventional ultrasonic devices which can supply a ultrasonic signal of 20 KHz to several MHz.

With reference to the accompanying drawing, the invention is illustrated in more detail.

FIG. 1 shows a schematic view of one of the plenty of microbubbles of a gas contained in the booster of the invention, wherein the microbubble of a gas has a diameter of 0.1 to 100 μm and is composed of a shell of human serum albumin (1) and gas (2) entrapped within the microbubble. The microbubbles are contained in a liquid (3) such as 5% human serum albumin solution in an amount of, for example, above 4×10^7 cells/ml.

The booster is mixed with a medicament to give a pharmaceutical liquid composition. The pharmaceutical liquid composition is directly administered to the diseased part with an appropriate device, for example, with a drug administration device (4) as shown in FIG. 2. The drug administration device (4) comprises a base tube (5) to which the pharmaceutical liquid composition is supplied, and an end tube (6) which is to be inserted into the tissue of the biobody and through which the pharmaceutical liquid composition is poured or injected into the diseased part. The end tube (6) is provided with a ultrasonic element (7) (e.g. a cylindrical ceramic oscillator, etc.). The ultrasonic element (7) is supplied by a ultrasonic signal of 20 kHz to several MHz from a ultrasonic oscillation circuit (8) via a conductor (9*a*), connectors (10*a*) and (10*b*) provided on the side of the base tube (5), a part of the base tube (5) and a conductor (9*b*) provided within the end tube (6).

The application or injection of a medicament is carried out in the form of a pharmaceutical liquid composition which is prepared by previously mixing the medicament with the booster comprising a plenty of microbubbles of a gas in a liquid, wherein the medicament and the booster are mixed in a ratio of 1:100 to 100:1 by weight. The pharmaceutical liquid composition is poured into the base tube (5) from the supply opening (11) provided on the tip of the base tube (5), passes through a flow path (12) within the base tube (5) and a flow path (13) within the end tube (6) and then administered to the diseased part or the portion close thereto of the patient via a pouring opening (14) provided at the bottom of the end tube (6).

When the pharmaceutical liquid composition is administered into the diseased part or the portion close thereto through the pouring opening (14), a ultrasonic energy generated from a ultrasonic element (7) is given to the liquid composition, by which cavitation occurs owing to the ultrasonic energy. Microbubbles are formed at the occurrence of cavitation and when the microbubbles are decomposed, energy is generated, by which diffusion and penetration of the medicament is promoted. Since the pharmaceutical liquid composition contains a plenty of microbubbles of a gas, the microbubbles act as a nucleus for the cavitation, by which the cavitation occurs more easily, in other words, the threshold value of occurrence of cavitation lowers. Accordingly, it is possible to generate the cavitation with less energy than the case of using no booster.

When a ultrasonic vibration is applied to a liquid, if the liquid contains any material being able to become a nucleus, the cavitation occurs generally at a lower threshold value of energy, but it has been found that the cavitation occurs most easily where the liquid contains microbubbles of a gas having a diameter of 0.1 to 100 μm.

The drug administration device (4) as shown in FIG. 2 can be used, for example, for administering a pharmaceutical liquid composition into a blood vessel. For instance, in the treatment of coronary thrombosis, a pharmaceutical liquid composition comprising a booster of the invention and a urokinase is injected into the part of thrombosis or the close portion thereof with the drug administration device (4) where the tip of the end tube (6) is inserted into the portion close to the thrombosis with applying ultrasound, by which the thrombolytic effects of the medicament are significantly increased and further the blood flow is recovered within a shorter period of time in comparison with the administration of the medicament without the booster. The drug administation device (4) may also be used for the removing hematoma in bleeding of brain. For example, a pharmaceutical liquid composition comprising a booster of the invention and a thromolytic agent (e.g. urokinase) is administered to the portion of hematoma with the drug administration device (4) with applying ultrasound like the above, by which the hematoma is easily lysed.

In another embodiment of the invention, the pharmaceutical liquid composition can be administered percutaneously with a drug administration device (15) as shown in FIG. 3.

In the drug administration device (15) suitable for percutaneous administration of a medicament, a layer of a medicament (17) is provided below a ultrasonic element (16) (e.g. a disc shaped ceramic oscillator, etc.), under of which an adhesive layer (18) having a medicament permeability is laminated, whole of which is covered with a plastic cover (19). The ultrasonic element (16) is supplied by ultrasonic signal from a ultrasonic oscillation circuit provided outside via a connector (20) like in the drug administration device (4) as shown in FIG. 2.

In the device (15) of FIG. 3, a pharmaceutical liquid composition comprising a mixture of a booster and a medicament is contained in the layer of a medicament (17). When this device (15) is used, it is adhered onto the skin with facing the adhesive layer (18) to the skin, and then a ultrasonic signal is supplied to the ultrasonic element (16), by which a ultrasonic vibration from the ultrasonic element (16) is given to both of the medicament layer (17) and the skin and thereby the medicament contained in the medicament layer (17) is passed through the skin and is penetrated into the tissue to be